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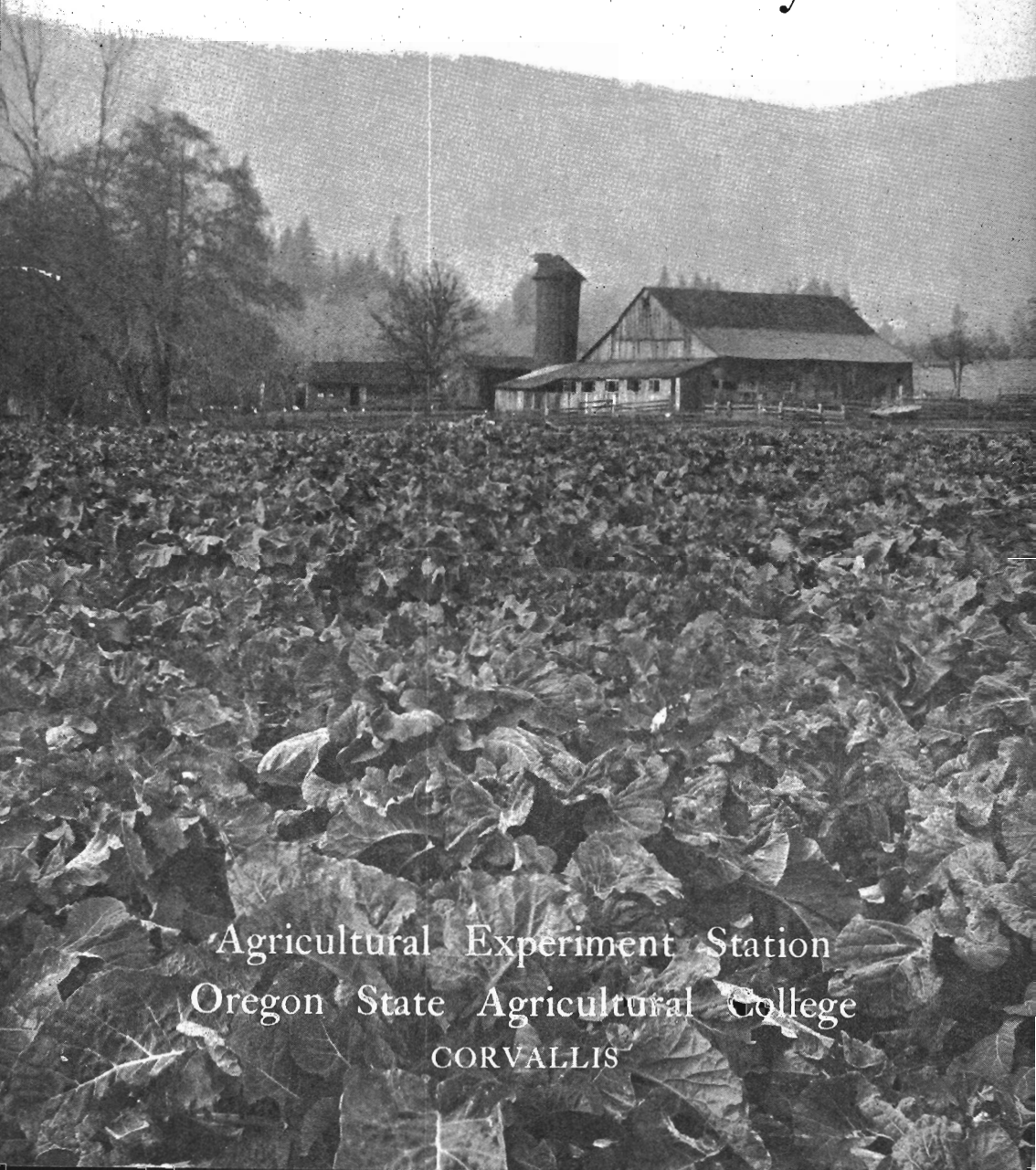
Cost of Producing Silage and Kale in the Willamette Valley



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SUCCULENT FEED CROPS IN THE WILLAMETTE VALLEY

Allowing three tons to a cow, Willamette Valley dairy cows consume annually nearly a third of a million tons of succulent feeds. The principal succulent feeds that are used are corn silage, vetch-and-oats silage, and kale.

* * *

The average cost of production for the three years 1925, 1926, and 1927 was $7.40 per ton for corn silage, $4.27 per ton for vetch silage, and $3.78 per ton for kale. These figures are based on 305 farm-survey records covering 2,506 acres producing 17,299 tons of silage and kale.

* * *

This study shows that there are a number of factors that can be controlled by the grower to reduce his cost of producing these crops. It is hoped that many farmers will obtain suggestions that will enable them to make material savings.

CONTENTS

SUMMARY

1. This bulletin presents information upon the cost of producing corn silage, vetch-and-oats silage, and kale, in the Willamette Valley; the factors affecting the cost; and ways of reducing it. It has two objectives: (1) to establish facts and principles for the use of present and prospective growers, teachers, and students of agriculture, and those concerned with public problems and policies; (2) to indicate to present growers possibilities of reducing their costs.

2. The facts presented were obtained in a state-wide study by the survey method of costs and practices in producing forage crops in Oregon during 1925, 1926, and 1927. The costs of the various hay crops are presented in separate bulletins.

3. The average cost of production for corn silage, with an average yield of 5.7 tons per acre, was $7.40 per ton; for vetch silage, with a yield of 7.9 tons per acre, $4.27 per ton; and for kale, with a yield of 18.1 tons per acre, $3.78 per ton.

4. The cost figures represent the total cost of production, include non-cash as well as cash items of expense, and give the grower wages for all of his work upon the crop and 5 percent interest on his investment. The strictly cash items amounted to only 36 percent of the total cost of corn silage, 42 percent of the total cost of vetch silage, and 37 percent of the total cost of kale.

5. Cost figures do not tell the whole story as to the comparative desirability of these crops; other factors such as feeding values, importance in the cropping system, and labor requirements, must also be considered.

6. There was wide variation in costs on different farms and in different years on the same farm. This variation in costs is caused partly by factors that the grower cannot control—for example, climatic conditions—and partly by management factors that he can control.

7. Some of the factors affecting the cost of silage and kale that this study indicates to be important are as follows:

Yield: For 29 corn-silage records with yields of less than 4 tons per acre the average cost was $12.08 per ton; for 19 records with yields of 10 tons or more the average cost was $5.03 per ton. A similar relationship between yield and cost was found for vetch silage and for kale.

Fertilization: Vetch silage that was land-plastered yielded 9.5 tons per acre as compared with 7.1 tons for that not land-plastered. Manuring was profitable for both corn and kale if the fertility left in the soil for future crops was considered.

Rate of seeding: Farms using 8 pounds or less of seed corn per acre obtained an average yield of 5.4 tons per acre; those using more than 8 pounds of seed obtained a yield of 6.0 tons. Farms using less than 40 pounds of vetch seed per acre obtained an average yield of 6.6 tons; those using 50 pounds or more, a yield of 8.8 tons.

Transplanting kale: Transplanting kale by hand required 25.0 hours of man-labor per acre as compared with only 13.4 hours where plant-setting

machines were used. Saving this much labor on only a few acres will cover the interest and depreciation cost of a machine.

Cultivation: The corn growers who did more cultivating obtained better yields at lower costs per ton; the amount of cultivation that is necessary depends, of course, upon the kind of land.

Binding corn vs. cutting by hand: On the average there was little difference in cost between binding corn and cutting by hand. The binder, however, eliminates the hard work of cutting by hand and the difficulty often experienced in getting a crew of men for cutting corn.

Cost of filling silos: The average cost of filling silos with corn silage (not including cutting the corn in the field) was $1.71 a ton. There was little difference in average cost between owned and hired silo filling outfits, or between the cost of filling with corn or vetch silage.

Size of silo filling crew: The larger silo filling crews were more efficient; with crews using 5 or 6 wagons the cost averaged $1.55 per ton, as compared with $2.06 per ton for crews using one or two wagons.

Length of haul: For an average difference in length of haul of 150 rods the extra cost of filling silos was 20c per ton.

Amount of silage per farm: On the farms that put up the larger amounts of silage, the costs per ton for filling the silo and for the use of the silo were considerably less.

8. Data on labor practices and requirements are given to show (1) the amount of each labor operation for each crop; (2) the average labor requirement for each operation; (3) the labor requirement for an acre of each operation on the average farm, on the more efficient farms, and on the less efficient farms; and (4) the seasonal distribution of the labor.

Acknowledgments. The author thanks the many farmers, county agents, and others whose willing cooperation has made this bulletin possible. Credit is due to numerous persons for helpful suggestions and assistance, particularly to Professor H. D. Scudder, under whose supervision the study has been conducted; to A. S. Burrier, E. B. Starkey, and C. D. Schoolcraft, who have assisted in the field work; and to Miss Helen Boyer for assistance in the tabulation. The departments of Animal Husbandry, Farm Crops, and Dairy Husbandry have given helpful cooperation in the study.

Cost of Producing Silage and Kale in the Willamette Valley

By

H. E. Selby

INTRODUCTION

At the rate of three tons to a cow, Willamette Valley dairy cows will consume annually nearly a third of a million tons of succulent feeds. As a matter of fact, on most farms where dairying is a major enterprise the annual consumption of succulent feed is considerably more than three tons per cow. The principal succulent feeds that are used are corn silage, vetch-and-oats silage, and kale. This bulletin presents information upon the cost of production, and factors affecting the cost, of these important dairy feeds.

Method of study.* The facts presented have been obtained in a study by the survey method of the costs of producing forage crops in Oregon during 1925, 1926, and 1927.† Data were obtained from typical farms in

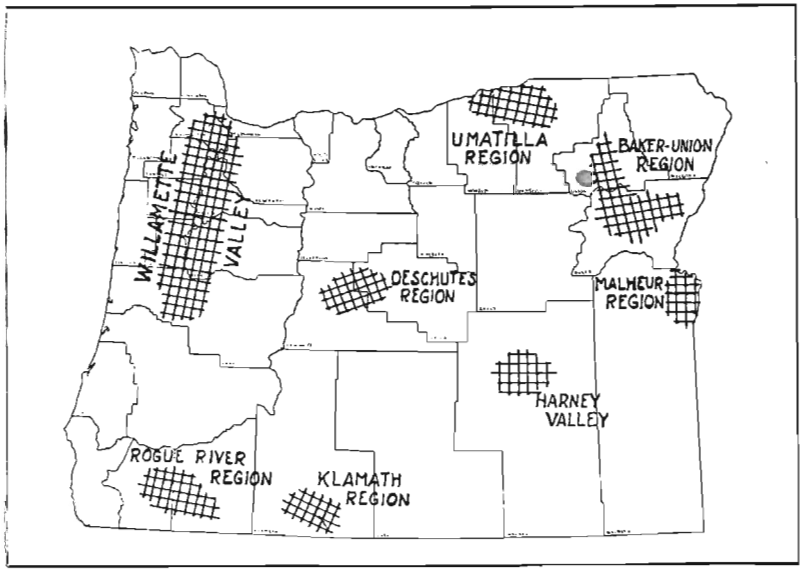

Fig. 1. Regions in which forage cost studies were made.

*For details of the methods used in the study see Appendix A.

†Hay crops included in this study are discussed in Oregon Agricultural Experiment Station Bulletin 241, Cost and Efficiency in Producing Alfalfa Hay in Oregon, and in Station Bulletin 248, Cost and Efficiency in Producing Hay in the Willamette Valley.

important forage-producing regions of the state (Fig. 1). In the Willamette Valley a total of 207 farms cooperated in the study, 76 for all three years, 72 for two years, and 59 for one year, an average of 143 farms each year.

The data were obtained in personal interviews with the operators of the farms during the winter following each crop season. Books or records were used whenever available, although most of the data were based upon estimates by the growers. As the study was continued for the three years many growers voluntarily kept labor and expense records in order to give accurate information.

Type of farming in the Willamette Valley. The crop and livestock enterprises on the farms included in this study are shown in tables XVII and XVIII. It is apparent that many different enterprises are possible under Willamette Valley conditions, and that the farming business is widely diversified.

Climatic conditions. The average annual rainfall in the Willamette Valley at Corvallis, based upon records for 40 years by the College Weather Station, is 42 inches; the average annual range in temperature is from 15° to 98° F.; and the average frost-free period is 181 days. In the winter of 1924-25 there was a period of unusually cold weather which killed some of the fall-sown vetch. This condition, however, had no serious effect upon the result of this study, and aside from this one feature the three years apparently were quite representative of Willamette Valley climatic conditions.

THE COSTS OF PRODUCING SILAGE AND KALE

Cost summary. The itemized average costs *per acre* of producing corn silage, vetch-and-oats silage, and kale, in the Willamette Valley, as determined by this study, are shown in Table I. The cost of the silage crops covers the growing of the crop, harvesting, and storing in the silo. The cost of the kale covers the growing of the crop and hauling to the barn to be fed. Corresponding costs *per ton* are given in Table XIX and the quantities of labor, seed, and fertilizer in Table XX.

Cost is not all cash expenditure. In considering or using these cost figures it should be kept in mind that they represent the total cost of production, include non-cash as well as cash items of expense, and give the grower wages for all of his work on the crop and 5 percent interest on his capital investment.

Any classification of cost items as to whether they are cash or non-cash must be more or less arbitrary, for the reason that some items are cash in one sense and non-cash in another. In Table II the items of the cost of producing silage and kale have been classified into four groups, as

follows: (1) strictly cash items, and items such as board of hired labor, horse feed, and seed, that are of similar nature; (2) the value of the unpaid labor of the operator and his family, which is not paid for in cash, but which involves cash expenditure for living expenses; (3) depreciation of machinery and equipment; (4) interest on capital invested in machinery and equipment. The first group, cash items, amounts to only 36 percent of the total cost of corn silage, to only 42 percent of the total cost of vetch silage, and to only 37 percent of total cost of kale.

There are different theories, of course, upon how cost of production should be computed. Those who wish to compute the cost on a different basis from that used in this bulletin may readily do so from the classified items in Table II.

TABLE I. AVERAGE COST PER ACRE OF PRODUCING CORN SILAGE, VETCH SILAGE, AND KALE IN THE WILLAMETTE VALLEY, 1925-1927

	Corn silage	Vetch-and-oats silage	Kale
Number of records	200	39	66
Number of acres	2,130	167	209
Number of tons	12,367	1,270	3,662
Direct man labor	$13.45	$ 8.42	$31.42
Overhead man labor	3.82	2.37	6.07
Horse labor	6.01	3.18	13.34
Tractor	3.34	2.46	2.36
Other machinery	3.46	2.83	2.15
Automobile	.14	.06	.03
Seed	.64	3.05	.47*
Fertilizer	.51	.17	2.60
Twine	.26	.08	.....
Use of silo	2.33	2.37	.....
Irrigation water	.....	.....	.48
Taxes	2.10	2.08	2.22
Interest on land value	6.94	7.21	7.55
Total	$43.00	$34.28	$68.69
Credit for pasture, ear corn, kale plants	.77	.51	.21
NET COST PER ACRE	$42.23	$33.77	$68.48
TONS PER ACRE†	5.70	7.90	18.10
COST PER TON	$7.40	$4.27	$3.78

*Including cost of kale plants that were purchased.
†These yields are averages of the 3 annual average yields and therefore do not check with the total acres and tons at the top of the table.
For detailed explanation of cost items see Appendix A.

Other factors are important. It is apparent from Table I that corn silage costs nearly twice as much, on the average, as either vetch silage or kale, and that the vetch silage costs a little more than the kale. These figures, however, do not tell the whole story as to the comparative desirability of these crops. Other factors such as feeding values, importance in the cropping system, and labor requirements, must also be considered.

Feeding values compared. In considering the feeding values of these crops, the following points are of interest.

1. A fairly reliable rule-of-thumb is that for dairy cows a ton of good corn silage is worth one-third as much as a ton of good hay.

2. Feeding experiments carried on by the Dairy Husbandry department of the Oregon Agricultural Experiment Station have indicated that vetch silage is as good as corn silage if not better.*

*Ore. Agric. Exp. Sta. Bul. 194, Oats and Vetch vs. Corn or Sunflowers for Silage.

3. Feeding experiments now being conducted by the Dairy Husbandry department seems to indicate that the feeding value of kale is nearly as great as that of average corn silage, when fed in the usual quantities. The kale analyzes lower in nutrients, but this seems to be offset by its greater succulence, palatability, and vitamin content.

TABLE II. CASH AND NON-CASH COSTS PER ACRE OF CORN SILAGE, VETCH SILAGE AND KALE, 1925-1927

Items	Corn silage Amount	Corn silage Percentage of total	Vetch-and-oats silage Amount	Vetch-and-oats silage Percentage of total	Kale Amount	Kale Percentage of total
Hired labor	$ 4.16		$ 3.62		$ 4.99	
Board	1.29		.53		2.38	
Horse feed and maintenance	4.28		2.24		9.78	
Horse labor hired	.17		.13		.....	
Tractor fuel and oil	1.44		.77		.95	
Tractor repairs	.31		.19		.29	
Other machinery repairs	.31		.21		.16	
Silo repairs	.12		.04		.....	
Tractor hire	.18		.09		.41	
Silo outfits hired (engine and cutter)	.51		1.45		.....	
Other machinery hired	.20		.10		.09	
Automobile operating expense	.14		.06		.03	
Seed	.64		3.05		.47	
Fertilizer	.51		.17		2.60	
Twine	.26		.08		.....	
Irrigation water	.....		.....		.48	
Taxes	2.10		2.08		2.22	
Total	$16.62		$14.81		$24.85	
Credit for pasture, ear corn, kale plants	.77		.51		.21	
NET TOTAL CASH COST	$15.85	37%	$14.30	42%	$24.64	36%
Operator's direct labor	7.30		4.10		23.16	
Overhead labor	3.82		2.37		6.07	
Unpaid family labor	.70		.17		.89	
TOTAL OPERATOR'S AND UNPAID FAMILY LABOR	$11.82	28%	$ 6.64	20%	$30.12	44%
Depreciation of horses, barn and harness	1.09		.57		2.49	
Depreciation of tractor	.94		.54		.59	
Depreciation of machinery	1.90		1.27		1.31	
Depreciation of silo	1.40		1.43		.....	
TOTAL DEPRECIATION	$ 5.33	13%	$ 3.81	11%	$ 4.39	6%
Interest on horses, barn and harness	.47		.24		1.07	
Interest on tractor	.21		.14		.12	
Interest on machinery	.80		.53		.59	
Interest on silo	.81		.90		.....	
Interest on land	6.94		7.21		7.55	
TOTAL INTEREST	$ 9.23	22%	$ 9.02	27%	$ 9.33	14%
TOTAL COST PER ACRE	$42.23	100%	$33.77	100%	$68.48	100%

There can be no question that there is a much greater difference in the costs of production of these crops than there is in their feeding values. Why, then, do so many Willamette Valley farmers grow corn silage, the high-cost feed, while comparatively few grow vetch silage and kale, the low-cost feeds?

Cultivated crop needed. One important factor is that corn is a cultivated crop. Farmers in the Willamette Valley need a cultivated crop that can be grown in comparatively large acreages. There is fundamental need in the Valley for more crop rotation, based upon grain, legume crop, and cultivated crop. Hence, even though it is expensive feed, the corn crop may be profitable from the standpoint of the farm business as a whole because it helps in controlling weeds and increasing the fertility of the soil.

Fig. 2. A small amount of land-plaster was planted with this corn, except in the case of the two rows in the center. Farm of Albert Eyman, Clackamas county. Dusting seed corn with pland-plaster, or applying the land-plaster with a fertilizer attachment on the corn-planter, often gives more vigorous growth.

There are, also, certain drawbacks in connection with vetch silage and kale. Vetch must be put in the silo at a rather busy season of the farmer's year. He is in the midst of haying and is getting ready for harvest. When only one man in a neighborhood wants to put vetch in his silo it is difficult to get a crew together. It is easier if several men in a community make vetch silage and work together for their silo filling.

Objections to kale. To kale, two objections are frequently heard. The first and most common is the disagreeableness of hauling kale in the mud and rain during the winter. This objectionable feature is reduced to a minimum by wearing a good slicker and gum boots and by hauling enough at a time to last two or three days so that fewer times of hauling will be necessary during unpleasant weather. Less man labor per ton was required for harvesting kale than for harvesting either corn or vetch silage.

The other objection is the danger of loss from freezing. It is noticeable that most of the complaints about this are from farmers who do not raise kale. Several growers who have been raising kale for many years stated that they recall only two years when they have had serious losses. There is more loss, of course, in some localities than in others. Kale is usually injured by temperatures below 13° F. unless protected by snow. At the College Weather Station the temperature has fallen below 13° in only 12 of the past 40 years. Many growers feed most of their kale before January 1, and in only three of the 40 years has the temperature fallen below 13° F. before then.

Both silage and kale important. Many farmers feed both silage and kale and think that both are necessary. They say that the silage helps to keep their cows in flesh and makes less grain feeding necessary, but that there is nothing like kale to bring the milk flow. The three crops can also be used to supply succulence at different seasons: vetch silage during late summer, kale during the fall and early winter, and corn silage during the last of the winter.

It is apparent that there are several angles to be considered and several other factors to be recognized when interpreting and comparing cost-of-production figures for these crops.

Costs are different on every farm. It should also be remembered that these cost figures are averages from large numbers of farms, and that there is wide variation in costs for varying sets of conditions on individual farms. (Table III.)

TABLE III. VARIATION IN COST PER TON ON DIFFERENT FARMS, 1925-1927

	Cost per ton	Percentage of farms
Corn silage	Less than $2.50	0%
	$ 2.50—$ 4.99	10%
	5.00— 7.49	35%
	7.50— 9.99	31%
	10.00 and over	24%
Vetch silage	Less than $2.50	2%
	$ 2.50—$ 4.99	68%
	5.00— 7.49	24%
	7.50— 9.99	6%
	10.00 and over	0%
Kale	Less than $2.50	8%
	$ 2.50—$ 4.99	66%
	5.00— 7.49	23%
	7.50— 9.99	3%
	10.00 and over	0%

This variation in cost on individual farms is caused by differences in a large number of factors that affect costs. These are of two types. The first type consists of conditions, such as kind of soil, prevalence of crop pests, and value of land. Most factors of this type cannot be changed or controlled by the grower to influence his costs except by changing his location, but their effect is of interest to prospective growers who are selecting

conditions that will be favorable or who are considering the adaptability of conditions that they already have.

The second type consists of management factors such as the acreage of the crop; methods of seeding, cultivating, fertilizing, and harvesting; efficiency in use of labor; and kind of equipment used. Most of these factors can be controlled by the grower to reduce his costs.

In the following pages will be discussed a number of the individual factors, both conditions and management factors, that in this study have discernible effects upon the costs of producing silage and kale in the Willamette Valley.

An average reduction of a fraction of a cent per ton in the cost of producing these succulent feed crops in the Willamette Valley would pay big dividends upon this investigation. It is hoped that many growers will obtain suggestions that will enable them to reduce their cost by dollars per ton.

FACTORS AFFECTING THE COST OF SILAGE AND KALE

Yield. Yield is usually the chief factor affecting the cost per unit of any farm product, cost per unit meaning cost per ton, per bushel, and so on. Accordingly, we find that yield per acre has a marked relationship to the cost per ton of silage and kale in the Willamette Valley (Fig. 3 and Table XXI). Low yields are associated with high costs per ton, and high yields with low costs.

The reason for this relationship between yield and cost is that a large part of the cost is a fixed amount per acre and is the same whether the yield is high or low. For example, the work of plowing the land is exactly the same whether the crop is large or small, taxes and interest on the land remain constant, and there is the same investment in machinery. With a high yield, then, the cost of these items per ton will be less than with a low yield. While this principle is well understood by most farmers, many do not appreciate its importance.

Poor yields of corn silage are very common in the Willamette Valley, as is apparent from Table XXI. The low average yield of 5.7 tons per acre largely accounts for the high average cost of this kind of succulent feed. As the table shows, many growers are finding it possible to obtain yields of 10 tons or more per acre, thus greatly reducing their cost per ton.

Yield, of course, is determined by many things. Some of the things that affect it, the grower cannot control; for example, climatic and soil conditions and the prevalence of insect pests or crop diseases. Other things —notably the various cultural practices—he can control.

A number of the factors that affect the cost of producing silage and kale do so through their influence upon yield, as will be apparent from the discussion of these factors that follows.

Value of land. The average value of the land used for corn silage was $139 per acre; for vetch silage, $144 per acre; and for kale, $151 per acre. Corn silage and vetch silage yields were higher on the higher-priced land, but no correlation is apparent between kale yields and land values (Table XXII). No definite relationship between value of land and cost of pro-

duction is indicated; if anything, cost per ton is slightly higher on the higher-priced land.

Varieties. The most common variety of corn was Minnesota 13, a variety that was developed and introduced many years ago by the Oregon Agricultural Experiment Station. Forty-three percent of the growers reported that they raised this variety exclusively, and several others used it for part of their planting. A number of growers knew their corn only as "Yellow Dent," and much of this probably was also Minnesota 13. Golden Glow and Pride of the North were raised by several growers, and Bloody Butcher, Minnesota 23, Leaming Yellow Dent, and other varieties, were found occasionally.

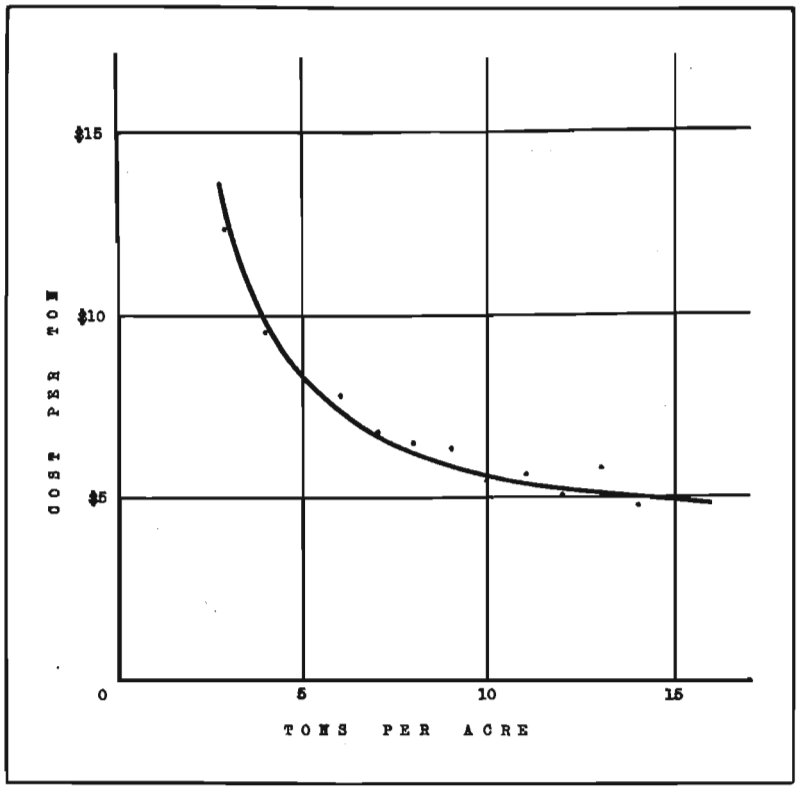

Fig. 3. The cost of corn silage comes down as the yield increases. For tabular presentation of the relation of yield to cost and other factors, for corn silage, vetch silage and kale, see Table 21. The equation for the curve, computed by the method of least squares, is $Y=(3.527x+17.546)\div(x-.777)$.

No significant differences in yield between the several varieties were apparent in this study. The Minnesota 13, however, undoubtedly makes a better quality of silage than most other varieties because of yielding a higher percentage of matured grain.

Of the total acreage of vetch silage 77 percent was Common vetch, 21 percent Hungarian or Hungarian and Common mixed, and 2 percent Sand vetch. Gray Winter oats were most generally sown with the vetch, although barley and wheat were used by a few growers. The average yield of Hungarian, and Hungarian and Common vetch mixed, was 7.9 tons per acre, as compared with 7.4 tons for the Common vetch. Apparently the Hungarian vetch, a comparatively recent introduction of the Oregon Agricultural Experiment Station, is proving excellent in yield as well as in other qualities claimed for it, such as hardiness and aphis resistance.

The variety of kale usually known as Thousand Headed was raised almost exclusively. There is considerable variation in the quality of plants from different strains of seed of this variety.

Fertilization. Table IV shows that higher yields were obtained from both corn and kale that was manured but that the cost of production also was higher. The reason for the higher cost is that no attempt has been made in this study to distribute the cost of applying fertilizer or manure to more than the current season's crop. If this were done, it would also be necessary to charge crops not fertilized in the current year for a share of the fertilizer applied in previous years, upon which it is usually impossible to obtain reliable information. It has been assumed that on the average the residual fertilizer value used by the current year's crop would about equal the value left in the soil for future crops.

TABLE IV. EFFECT OF MANURING UPON YIELD AND COST OF CORN AND KALE, 1925-1927

		Number of records	Loads manure per acre	Yield per acre	Cost per ton†	Land value per acre
				tons		
Corn	Not manured*	85	.....	5.3	$6.93	$129
	Manured	115	8.8	6.1	7.95	152
	Average	200	4.5	5.7	$7.40	$139
Kale	Not manured*	15	.....	15.7	$3.37	$161
	Manured	51	15.3	18.4	3.95	148
	Average	66	11.8	18.1	$3.78	$151

*Not manured in current season.
†See accompanying discussion for explanation of the higher cost of the crop that was manured.

In Table IV, then, the crop that was not manured should have an additional charge for fertility left from manuring in previous years and the crop that was manured should have a credit for fertility left in the ground for future crops. When this is taken into consideration there can be no question that spreading manure was a profitable practice for both corn and kale.

An average of 51 pounds of land-plaster per acre was applied to 22 percent of the vetch silage acreage. The average yield of the silage that was land-plastered was 9.5 tons per acre as compared with 7.1 tons per acre for that not land-plastered.

Plowing vs. disking for vetch. The land was plowed for about two-thirds of the vetch silage; for the other third it was only disked. The disked land was, of course, mostly land that had been plowed the previous

spring. The average yield of silage was 8.6 tons per acre on the disked land and only 7.0 tons per acre on the plowed land.

Cost of production was less for the disked-in vetch, averaging $4.12 a ton as compared with $4.44 for the vetch on plowed land.

Rate of seeding. The average amount of seed corn used per acre was 9.4 pounds. Slightly higher yields were obtained with the heavier rates of seeding (Table V).

TABLE V. IT PAYS TO USE ENOUGH SEED

	Seed per acre	Silage per acre
	lbs.	*tons*
Corn silage	8 or less	5.4
	Over 8	6.0
Vetch silage	Less than 40*	6.6
	40—49	8.2
	50 and over	8.8

*Vetch seed only.
For additional details see tables XXIII and XXIV.

The average rate of seeding for the vetch-and-oats silage was 39 pounds of vetch and 61 pounds of oats per acre. Larger proportions of vetch in the mixture of seed gave considerably higher yields (Table V).

Seed is a very small item in the cost of producing kale. A pound of good seed should produce enough strong plants for an acre, which is about 5,000 plants if they are set 36 inches apart each way.

Date of planting. For the three years, 60 percent of the corn acreage was planted before May 15 and 40 percent after that date. The average yield was 6.1 tons per acre for the earlier plantings and 5.3 tons per acre for the later plantings.

The vetch-and-oats silage was sown from September to November, but mostly in October. No difference in yield between the early and late fall seeding was apparent.

Transplanting of kale was done from May to August, but mostly in June. No relation between date of transplanting and yield was apparent. With later transplanting there is less root-maggot injury, less danger of plants going to seed before spring, and better opportunity to control weeds by tillage before setting out the plants and thus eliminate some of the later cultivation. The ground should be thoroughly tilled, however, up to the time of transplanting to conserve moisture and control weeds.

Method of transplanting kale. Kale plants usually are raised in a seed-bed and are transplanted to the field when several inches high. The transplanting is most commonly done by hand; two men, or a man and a boy, work together, one making an opening in the ground with a spade or shovel, and the other inserting the plant (Fig. 4). Fifty-one percent of

the kale acreage was transplanted in this way, 8 percent by "plowing in" the plants, and 26 percent by the use of plant-setting machines (Figs. 5 and 6).

Fig. 4. Transplanting kale by hand. Two men, or a man and a boy, usually work together, one making a hole with a shovel or spade and the other inserting the plant.

The remaining 15 percent of the acreage was seeded directly in the field. This was done in various ways, among them the use of garden drills, a corn-planter with special plates, dropping the seed through a pipe, and dropping the seed from a pepper-shaker. But transplanting seems to be preferable. The transplanted kale gave better yields and the saving in work of transplanting by seeding directly in the field was largely offset by the extra thinning and hoeing that this made necessary.

TABLE VI. A PLANT-SETTER SAVES LABOR IN TRANSPLANTING KALE

Method of transplanting	Man-hours per acre
By hand	25.0
Plant-setter	13.4

Transplanting with planters required only 13 man-hours per acre as compared with 25 for transplanting by hand. With as large a saving in labor as this, very few acres are necessary to cover the interest and depreciation on a plant-setting machine. Extra horse labor is involved, of course, but if the team is available the extra cost for using it is small.

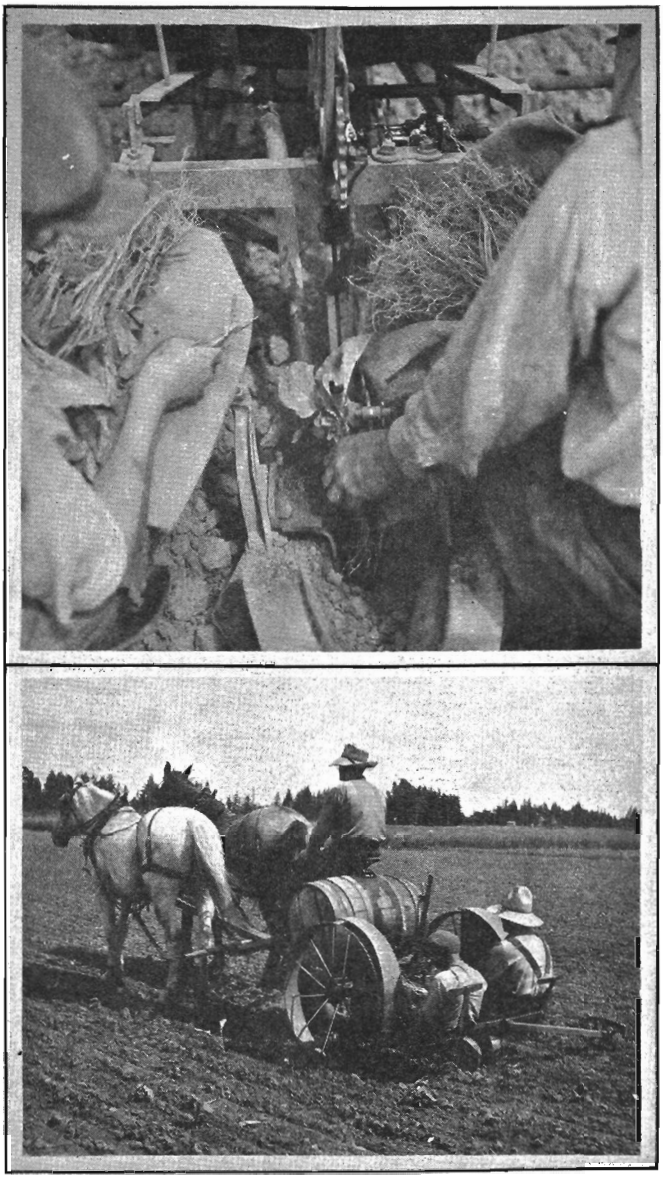

Fig. 5. Transplanting kale with a plant-setting machine. Above, the plant-setting mechanism. Water is dropped on each plant. Farm of August Nielson, near Amity.

Cultivation. The corn growers who cultivated most often obtained the best yields and the lowest costs per ton (Table VII). The number of cultivations in this table covers all forms of cultivating, including harrowing while the corn is small, and hoeing, in addition to the use of corn-cultivators. Doubtless the higher yield with more cultivation is partly because

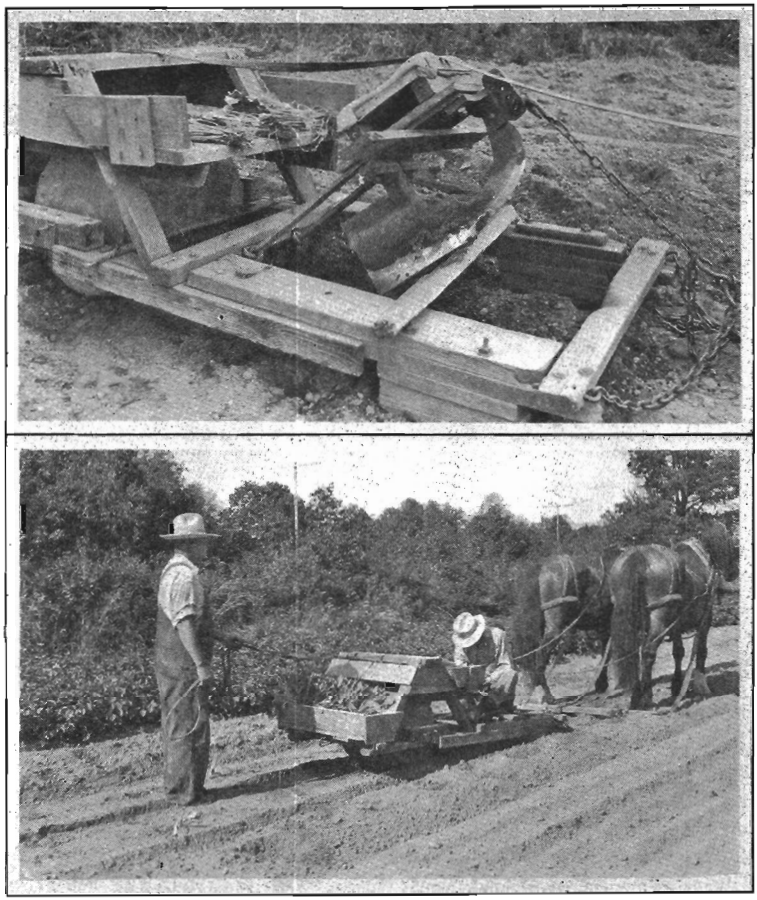

Fig. 6. A home-made device for transplanting kale. Farm of E. A. Canning, Linn county.

river-bottom land that produces some of the highest yields is often quite weedy and therefore requires many cultivations. These data seem to indicate, however, that more cultivation of corn in the Willamette Valley would be profitable. Harrowing the field while the corn is only a few inches high is a low-cost form of cultivation.

With kale, the amount of cultivation apparently had no relation to yield. Much of the cultivation of kale can be eliminated by destroying weeds by thorough tillage before setting out the plants. By doing this,

many growers obtain good yields with comparatively little cultivation, and hence at a lower cost.

Binding corn vs. cutting by hand. Sixty percent of the corn silage acreage was cut with corn-binders, 39 percent by hand, and 1 percent with sled cutters. The costs of binding with owned corn-binders, with rented corn-binders, and by hand, are compared in Table VIII.

TABLE VII. CORN SHOULD HAVE PLENTY OF CULTIVATION

200 records — Corn silage — 1925-1927

Number of cultivations*	Tons per acre	Cost per ton
1—2	4.5	$8.03
3—4	5.3	$7.66
5 or more	6.8	$7.04

*Including harrowing and hoeing.
For additional data see Table XXV.

TABLE VIII. COMPARATIVE COSTS OF BINDING CORN AND CUTTING BY HAND, 1925-1927

Items	Corn-binder owned	Corn-binder hired	Cutting by hand
Number of records*	77	11	95
Acres corn per farm	12	10	8
Yield per acre (tons)	5.3	4.7	6.3
	Costs per acre		
Man labor	$0.67	$0.59	$2.23
Horse labor	.58	.51	.....
Interest on corn-binder	.21	.....	.....
Depreciation of corn-binder	.58	.....	.....
Repairs for corn-binder	.18	.....	.....
Hire of corn-binder	.....	.64	.....
Twine	.41	.34	.....
TOTAL COST PER ACRE	$2.63	$2.08	$2.23

*Farms using sled cutters, farms cutting partly with binders and partly by hand, and farms that borrowed corn-binders, are omitted from this tabulation.

Apparently the use of corn-binders is not cheaper than cutting by hand, on the average. On many individual farms, of course, the costs are much higher or lower than the average.

The biggest part of the cost of using a corn-binder is for depreciation and interest. These items are less per acre if the binder is used to cut a larger acreage during the year, thus dividing the cost between more acres. Many growers accomplish this by owning a binder jointly with neighbors; others, by doing custom work.

Most growers would prefer to use a binder even though it costs as much or more than cutting by hand because of the hard work that it eliminates, and because it is often difficult to get a crew of men for cutting corn.

Cost of filling silos. The average cost per ton of filling silos with corn and with vetch-and-oats is shown in Table IX. These costs cover only the hauling from the field and putting in the silo; they do not include the

cutting of the crop in the field. The cost of cutting corn in the field has been given in Table VIII.

TABLE IX. AVERAGE COST PER TON OF FILLING SILOS. 1925-1927

Items	Corn silage (200 records)	Vetch-and-oats silage (39 records)
Direct man labor*	$0.84	$0.87
Overhead man labor	.22	.24
Horse labor	.22	.20
Use of wagons	.03	.03
Use of cutter†	.20	.23
Use of engine†	.20	.19
TOTAL	$1.71	$1.76

*Computed at 40 cents per hour.
†Where the silo filling outfit was hired, one or two men usually accompanied the outfit and were included in the cost. Wages for these men have been deducted and included under direct man labor, and the remaining cost divided equally between cutter and engine.

Tractors were used for power in 179 of the 200 corn-silage records, stationary engines in 20, and an electric motor in one. In 83 of the records in which tractors were used both the tractor and cutter were owned by the grower, in 52 both were hired, in 24 the tractor was hired and the cutter owned, and in 20 the tractor was owned and the cutter hired. On the average there was very little difference in the costs per ton between the stationary engines and tractors or between the owned and hired silo outfits.

Custom charges for filling silos varied from $1.50 to $3.00 per hour for the cutter, engine, and one or two men. A number of outfits also charged flat rates of from $10 to $30 per silo. After deducting wages for the men furnished with the outfits, the average charge for cutter and engine alone was $1.97 per hour.

The principal factors that seem to affect the cost of filling silos are the size of the crew and the length of haul.

Size of silo filling crew. The cost per ton of filling silos was less with the larger silo filling crews (Table X). A man is required for pitching off the load, another for feeding the cutter, and the engine must operate, whether two tons per hour are being handled, or six. Larger and more expensive machinery is necessary with the larger crews, but the average machinery cost per ton was less (Table XXVI), undoubtedly because there was sufficiently more use of the larger outfits more than to offset their greater depreciation and interest cost. It should be noted that the lower cost with the larger crews was in spite of a longer haul.

TABLE X. THE LARGER SILO FILLING CREWS ARE MOST EFFICIENT
200 records — Corn silage — 1925-1927

Number of wagons used	Cost per ton of filling silo
1—2	$2.06
3—4	$1.76
5—6	$1.65

For additional details see Table XXVI.

Length of haul. Between the shortest- and longest-haul groups in Table XI there is a difference in average length of haul of 150 rods, or about half a mile. The corresponding difference in amount of labor required per ton is .3 man-hour and .6 horse-hour. At 40c per hour for man labor, 12½c for horse labor, and disregarding the extra wear and tear on the wagons, this amounts to 20c per ton.

TABLE XI. RELATION OF LENGTH OF HAUL TO AMOUNT OF LABOR REQUIRED IN FILLING SILOS
(Corn silage, 1926-1927)

Length of haul	Number of records	Average haul	Average crew		Labor per ton filling silo	
			Men	Horses	Man-hours	Horse-hours
rods		*rods*				
Less than 40	38	22	8	6	1.9	1.4
40—79	47	48	9	7	2.0	1.6
80—119	49	84	9	7	2.1	1.7
120 and over	32	172	9	8	2.2	2.0
Average	166	77	9	7	2.1	1.7

The additional labor required for the longer hauls is rather low for the additional length of haul involved; apparently, therefore, the crews with the longer hauls were somewhat more efficient. Probably on the longer hauls larger loads were carried; and possibly on the shorter hauls the number of men and teams was a little too large, on the average, for the length of haul and size of the cutter.

TABLE XII. THE FARMS WITH THE MOST SILAGE MAKE IT MOST CHEAPLY
200 records — Corn silage — 1925-1927

Tons of silage per farm	Cost of filling silo per ton	Cost of use of silo, per ton
Less than 50	$2.21	$0.49
50—99	$1.62	$0.46
100 and over	$1.36	$0.25

For additional data see Table XXVII.

Amount of silage per farm. Both the cost of filling and the cost of the use of the silos were less per ton on the farms that put up the larger amounts of silage (Table XII). The cost of filling was less because in general the farms with the larger amounts of silage used the larger and more efficient silo outfits and crews. The cost of the storage in the silos was less because the silos were filled more nearly to capacity, thus dividing the total cost between more tons, and also because the cost per ton for the silo building undoubtedly is less with larger silos.

LABOR PRACTICES AND REQUIREMENTS

A number of the labor operations on silage and kale in the Willamette Valley have been discussed to some extent in the preceding pages. All of the operations will now be summarized in greater detail.

In tables XIII, XIV, and XV are shown for corn silage, vetch silage, and kale, respectively, the amount of each operation and the average amounts of man, horse, and tractor labor that were used. The amounts of labor in these tables are not for an acre once over of each operation, but for the amount of each operation on an average acre of crop, which may be more or less than for an acre once over of the operation. For labor for an acre once over see Table XXVIII.

TABLE XIII. LABOR PRACTICES AND AVERAGE LABOR REQUIREMENTS FOR CORN SILAGE, 1925-1927

Operation	Percentage of acreage covered	Times over	Labor per average acre* Man-hours	Horse-hours	Tractor-hours
	%				
Manuring	41	1.0	4.0	7.3	....
Plowing	99	1.1	3.2	5.7	1.2
Disking	91	2.2	1.8	2.5	1.1
Rolling	72	2.0	1.0	2.4	.2
Spike harrowing	80	2.2	1.0	2.5	.2
Spring-toothing	44	2.1	.7	1.4	.3
Floating	28	1.8	.3	.7	.1
Planting	100	1.1	1.2	2.1	....
Spike harrow after planting	34	1.3	.3	.7	....
Cultivating, two-horse	88	3.0	4.2	8.3	....
Cultivating, other	28	2.8	1.1	1.4	....
Hoeing and weeding	42	1.2	2.6	....	....
Binding	60	1.0	1.0	2.8	....
Cutting by hand	39	1.0	2.2	....	....
Haul and fill silo	100	1.0	12.1	10.1	1.2
Miscellaneous	.....	....	.4	.4	.1
TOTAL	.....	....	37.2	48.3	4.4

*These figures are averages for the entire acreage of corn silage, irrespective of whether the operation was performed or not, or of whether horses or tractors were used.

TABLE XIV. LABOR PRACTICES AND AVERAGE LABOR REQUIREMENTS FOR VETCH SILAGE, 1925-1927

Operation	Percentage of acreage covered	Times over	Labor per average acre* Man-hours	Horse-hours	Tractor-hours
	%				
Fertilizing	36	1.0	.2	.4	....
Plowing	49	1.0	1.0	1.2	.6
Disking	59	1.6	.7	1.5	.2
Spike harrowing	58	1.7	.5	1.6	.0
Seeding	100	1.0	.8	2.2	.0
Mowing	79	1.0	1.6	3.0	.0
Raking	56	1.0	.3	.6	....
Binding	21	1.0	.3	.8	....
Haul and fill silo	100	1.0	17.9	14.5	2.4
Miscellaneous	.....	....	.3	.6	.1
TOTAL	.....	....	23.6	26.4	3.3

*These figures are averages for the entire acreage of corn silage, irrespective of whether the operation was performed or not, or of whether horses or tractors were used.

How many acres is a day's work? Table XVI shows the amount of various operations that was accomplished in a day on the average farm, on the 10 percent of the farms that did the most in a day, and on the 10 percent of the farms that did the least in a day.

The variation in amount of work accomplished on different farms is caused partly by differences in conditions such as kind of soil or shape of the field, and partly by the efficiency with which the work is performed. The efficiency with which the work is performed is determined by such factors as the kind and size of equipment used; size and condition of the horses, or of the tractor; and the energy and skill of the man doing the work.

TABLE XV. LABOR PRACTICES AND AVERAGE LABOR REQUIREMENTS FOR KALE, 1925-1927

Operation	Percentage of acreage covered	Times over	Labor per average acre* Man-hours	Horse-hours	Tractor-hours
	%				
Manuring	76	1.0	10.6	18.7	....
Plowing	100	1.2	3.9	7.6	1.2
Disking	91	3.1	3.1	6.8	1.3
Rolling	80	3.0	1.9	4.2	.2
Spike harrowing	84	3.3	1.9	4.9	.1
Acme harrowing	12	3.1	.4	.8	....
Spring-toothing	31	2.5	.6	1.2	.2
Floating	27	1.7	.3	.7	.1
Raising plants	64	1.0	1.5	.0	....
Marking	27	1.0	.3	.4	....
Transplanting by hand	51	1.0	11.6	....	....
Transplanting by machine	26	1.0	3.6	2.0	....
Transplanting by plowing in	8	1.0	1.4	.4	.1
Seeding directly in field	15	1.0	.8	....	....
Cultivating	79	2.5	4.6	7.0	.0
Hoeing and weeding	72	1.8	6.1	....	....
Ditching and irrigating	4	1.0	.6	.1	....
Cutting and hauling	95	1.0	34.7	51.8	....
Miscellaneous	....	....	.3	.0	....
TOTAL	....	....	88.2	106.6	3.2

*These figures are averages for the entire acreage of corn silage, irrespective of whether the operation was performed or not, or of whether horses or tractors were used.

Growers who would reduce their cost of production, or keep it at a minimum, must keep their labor requirements as low as possible. Their aim should be the maximum efficiency indicated in the table, in so far as their conditions permit.

Seasonal distribution of operations. The seasonal distribution of man labor on corn silage, vetch silage, and kale, is shown graphically in Fig. 7. These diagrams are necessarily rather arbitrary, as there are countless variations from them on individual farms and in different seasons. They show in a general way, however, the periods during which the various operations are performed.

It is apparent that for the silage crops the peak labor load is silo filling, and for kale, transplanting. As brought out in the preceding discussion, the labor for transplanting kale can be greatly reduced by using a transplanting machine.

TABLE XVI. AN AVERAGE, A LARGE, AND A SMALL DAY'S WORK FOR VARIOUS OPERATIONS

Operations	Acres covered per man in ten hours		
	All farms	10% of farms covering the most acres	10% of farms covering the fewest acres
	acres	*acres*	*acres*
Manuring for corn, spreader	1.0	3.0	.5
Manuring for kale, spreader	.7	1.8	.3
All manuring with spreader	.9	2.5	.4
All manuring, wagon or sled	.6	1.0	.3
Plowing for corn, horses	2.0	3.2	1.3
Plowing for corn, tractor	5.4	9.2	2.7
All plowing, horses	2.1	3.7	1.3
All plowing, tractor	5.6	9.4	3.4
Disking, horses	7.0	14.9	3.8
Disking, tractor	14.1	25.0	8.7
Rolling, horses	12.4	21.7	8.1
Rolling, tractor	20.0	34.5	9.8
Spike harrowing, horses	17.6	33.3	10.5
Spike harrowing, tractor	21.8	45.5	12.3
Spring-toothing, horses	9.0	18.5	5.9
Spring-toothing, tractor	14.9	32.3	8.4
Floating, horses	13.5	26.3	9.3
Floating, tractor	16.7	23.8	12.0
Drilling, horses	11.5	18.5	7.7
Drilling, tractor	19.6	62.5	9.8
Planting corn with planter	8.9	15.6	5.5
Marking and planting by hand	2.5	6.4	1.2
Transplanting kale by hand	.4	.8	.2
Transplanting kale by machine	.7	1.9	.5
Cultivating corn, 2 horses	6.5	9.4	4.6
Cultivating corn, 1 horse	5.1	11.6	2.6
Cultivating kale	3.5	7.7	1.4
Cutting corn with corn-binder	5.9	9.7	3.3
Cutting corn by hand	1.6	3.4	.9
Filling silo, corn silage	.8	1.7	.4
Filling silo, vetch silage	.5	1.3	.3
Hauling kale	.3	.7	.1

For number of records and man and horse hours per acre for each operation, see Table XXVIII.

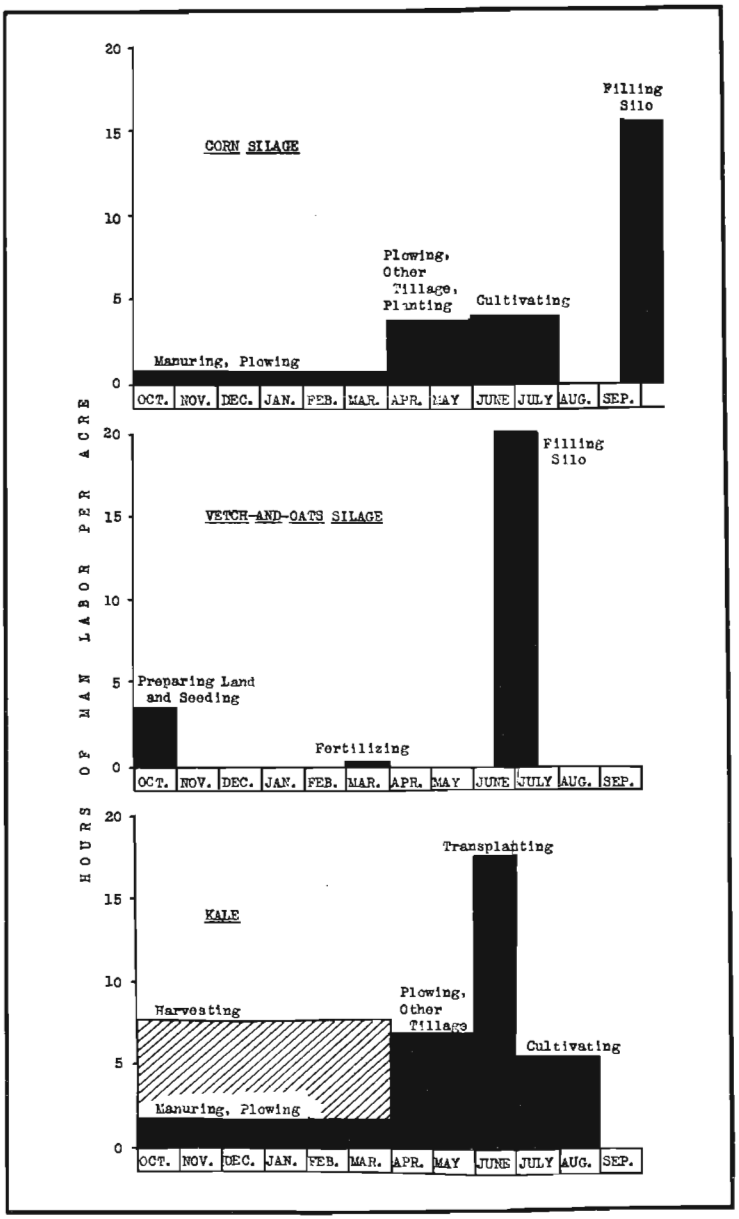

Fig. 7. Seasonal distribution of man labor for corn silage, vetch silage, and kale.

Appendix A

DETAILS OF METHODS USED IN THE STUDY

Considerable difference of opinion is possible on many practices in computing and analyzing farm costs. In this study effort has been made to conform in general with commonly accepted procedure, such as there is, in studies of this kind; but the primary aim has been to accomplish the objectives of the study, and any procedure that has promised to facilitate this has been adopted. It is thought that such defensible differences in procedure as might be suggested would have no appreciable effect upon the validity of the conclusions that have been drawn.

Sampling. With the assistance of county agents and others familiar with local conditions, representative farms were selected in each county from the different sets of conditions and different types of production in the county. Effort was made to avoid too large a proportion of either the larger or smaller farms, or the better or poorer farms or farmers. It is the judgment of those associated with the work that representative cross-sections have been obtained of the production of the several crops. With the number of records that could be taken, and the variation that exists in conditions and types of production, the samples are probably as reliable as could be obtained by any other method of sampling.

The same farms were included each year as much as possible, but a few were dropped and others added in the second and third years in order to obtain more representative farms; or because absence or illness of the operators, or other conditions, prevented including certain farms.

The number of farms was also increased or decreased from year to year in some of the regions in accordance with the relative importance of the region as brought out by the continued study. In the entire forage cost study a total of 549 farms cooperated, 217 for all three years, 133 for two years, and 199 for one year. The number of farms averaged 143 per year in the Willamette Valley, and 36 per region per year in the seven other regions.

During the three years, 1,505 enterprise records of individual crops of forage were obtained. These covered in the aggregate 49,547 acres producing 146,805 tons of forage. In addition there were 400 records upon the cost of seeding alfalfa and clover; and 196 records of the cost of horse labor were obtained in a supplemental study in 1926.*

Method of analysis. The data have been analyzed chiefly by the method of grouping and cross-tabulating. It was thought that the modifications of conclusions, or additional conclusions, that might be reached by mathematical correlation methods would hardly justify the procedure involved, especially since the data upon several of the factors are not adapted to such methods. In studying a given causal factor, effort has been made to tabulate with it any other factors that might be correlated with it, and to consider any correlation thus indicated when drawing conclusions.

*The costs of horse labor are presented in Oregon Agricultural Experiment Station Bulletin 250, Cost of Horse Labor on Oregon Farms.

Discarding and omitting records. Records of farms with unquestionably abnormal conditions and records that for any reason appeared unreliable were discarded. Except for such records, however, all records for the crop concerned have been included in all of the tabulations unless otherwise definitely indicated.

Averaging. The general principle has been followed of averaging value per acre rather than values per farm or per ton. For corn silage, in averaging together tabulations for the different years the groups for each year have been averaged separately and the unweighted annual averages for each group then averaged together in order to avoid undue weighting from irregularity of numbers of records in individual groups. For vetch silage and kale, however, because of the small number of records in each year, the three years' records have been combined together before averaging.

Renters figured as owners. Most of the cooperators were owners. In all cases of rented land, to make the records comparable, the cost was computed as though the land were owned by the grower, charging the taxes and interest on the value of the land instead of the cash or share rent paid.

Direct man labor. This is all of the man labor expended directly upon the crop, including the work of the grower himself, members of his family, and hired labor, valued at prevailing wages for farm labor. If board was furnished in addition to wages its value has also been included. The average total cost per hour for direct man labor for all of the Willamette Valley forage crops that were studied was 35c in 1925, 36c in 1926, and 36c in 1927. These figures cover both hired and operator's labor, and the hay crops as well as silage and kale.

Overhead man labor. This is the amount chargeable to the crop for indirect and overhead labor such as general repairing and upkeep, general supervision, and attending to general farm business matters. A careful estimate was made of the proportions of each grower's total year's work that were chargeable to his various farm enterprises. The overhead labor is the difference between the amount of labor thus charged and the grower's direct labor upon the crop. For corn silage it amounts to 9 percent of the total cost; for vetch silage, to 7 percent; and for kale, to 9 percent.

Horse labor. The work of the grower's own horses was charged in the Willamette Valley at 12.5 cents per horse-hour. This rate is supported by the supplementary study of the cost of horse labor that was made in 1926. A small amount of work by horses that were hired is charged at the actual price paid.

Machinery, tractor, automobile, and silo. Estimates were obtained of the proportions chargeable to each crop of the fuel and oil, repairs, depreciation, and interest, for each piece of equipment. Depreciation is based upon the original cost and total life of the equipment. Interest is computed at 5 percent upon the present value. The cost of rented machinery is included at the actual price paid.

Seed. Charged at prevailing market value on the farm.

Fertilizer. Commercial fertilizers are charged at the actual cost to the grower. Manure is charged at the value placed upon it by the grower. Most of the growers figured manure as worth only the labor of putting it upon the field, which is included under man and horse labor. In some places, however, manure has well-established cash values, and these values have been charged in such localities. The cost of fertilizer and manure has been charged entirely to the current year's crop, assuming that on the average the amount of fertility left in the soil for succeeding crops is equivalent to that remaining from preceding crops.

Taxes. The charge for taxes is the total state and county tax paid upon the land used for the crop as determined from the reports of the growers and assessors' records.

Interest upon land value. Interest at 5 percent is charged on the value of the land used for the crop as given by the growers. The value that the growers were asked to give was the present asking price in the locality for land of comparable value.

Credits. Credit has been made for the value of any pasture obtained from the field after the crop was harvested, for ear corn that was picked out and not put into the silo, and for kale plants that were sold. These items were valued at the price received, if sold, or as estimated by the grower if used by him.

Yield. Yields of silage were estimated from the size of the silos and heights to which they were filled, using silage weights as given in Missouri Experiment Station Bulletin 164. Yields of kale in most cases were based upon the estimated weight of a load and the number of loads hauled during the season. This was found to give much more reliable estimates than weighing plants and estimating the number per acre.

Appendix B

SUPPLEMENTARY AND DETAILED TABLES

(Tables XVII to XXVIII, inclusive)

TABLE XVII. KINDS AND AMOUNTS OF CROPS RAISED ON THE WILLAMETTE VALLEY FARMS FROM WHICH COST DATA WERE OBTAINED

(430 farm records, 1925-1927)

Crops	Acres per farm (all farms)	Percentage of farms growing each crop	Acres per farm growing the crop
	acres	%	*acres*
Wheat	31.0	82	37.9
Oats	28.2	85	33.3
Barley	5.5	36	15.3
Clover hay	12.0	57	21.1
Clover seed	3.0	10	30.7
Clover seeding	3.4	15	23.2
Vetch-and-oats hay	13.3	67	20.0
Alfalfa hay	2.6	24	10.5
Cheat hay	2.8	23	12.2
Grain hay	.3	2	14.0
Timothy hay	.5	3	15.1
Rye-grass hay	.8	4	18.6
Wild oats hay	.7	2	29.3
Mixed, wild, and volunteer hay	.9	7	13.2
Corn silage	5.9	56	10.5
Corn, other uses	2.7	31	8.9
Vetch-and-oats silage	.3	7	4.0
Vetch seed	5.2	20	26.7
Rye-grass seed	2.1	3	77.6
Kale	.6	23	2.5
Potatoes	1.2	34	3.5
Vegetables	.8	18	4.4
Small fruits	.2	5	3.6
Orchard	1.7	14	12.2
Other crops	1.4	11	13.1
Total crops	127.0	100	127.0
Pasture	65.3	88	74.5
Fallow	2.7	12	21.8
Farmstead and waste	23.6	100	23.6
TOTAL FARM ACREAGE	218.6	100	218.6

TABLE XVIII. KINDS AND AMOUNTS OF LIVESTOCK KEPT ON THE WILLAMETTE VALLEY FARMS FROM WHICH COST DATA WERE OBTAINED

(430 farm records, 1925-1927)

Kind of livestock	Number head per farm (All farms)	Percentage of farms keeping each kind of stock	Number head per farm keeping each kind of stock
		%	
Horses	4	98	4
Milk cows	12	98	12
Other cattle	8	79	10
Sheep	29	37	78
Goats	4	12	35
Hogs	22	68	32
Chickens	134	95	141
Turkeys	7	18	41

TABLE XIX. AVERAGE COST PER TON OF PRODUCING CORN SILAGE, VETCH SILAGE, AND KALE, 1925-1927

	Corn silage	Vetch-and-oats silage	Kale
Direct man labor	$2.36	$1.06	$1.73
Overhead man labor	.67	.30	.33
Horse labor	1.05	.40	.74
Tractor	.58	.31	.13
Other machinery	.62	.36	.12
Automobile	.02	.01	.....
Seed	.11	.39	.03
Fertilizer	.09	.02	.14
Twine	.04	.01	.....
Use of silo	.41	.30	.....
Irrigation water	.....	.....	.03
Taxes	.37	.26	.12
Interest on land	1.21	.91	.42
Total	$7.53	$4.33	$3.79
Credit for pasture, ear corn, kale plants	.13	.06	.01
TOTAL NET COST PER TON	$7.40	$4.27	$3.78
TONS PER ACRE	5.7	7.9	18.1

TABLE XX. AVERAGE QUANTITY COSTS PER ACRE OF SILAGE AND KALE, 1925-1927

Items		Corn silage	Vetch-and-oats silage	Kale
Man labor	hrs.	37.2	23.6	88.2
Horse labor	hrs.	48.3	26.4	106.6
Tractor work	hrs.	4.4	3.3	33.2
Seed	lbs.	9.4	99.8*	†
Fertilizer	lbs.	5.6	11.2	.....
Manure	loads	4.5	.2	11.8
Twine	lbs.	1.4	.4	.....

*38.7 pounds vetch; 61.1 pounds grain.
†Less than 1 pound per acre.

TABLE XXI. RELATION OF YIELD TO COST OF PRODUCTION AND OTHER FACTORS, 1925-1927

	Yield per acre	Number of records	Average yield per acre	Acres per farm	Value land per acre	Total cost Per acre	Total cost Per ton	Man labor per ton
	tons		*tons*	*acres*				*hours*
Corn silage	Less than 4.0	29	2.8	11.3	$124	$35.85	$12.08	10.7
	4.0—5.9	77	4.9	12.5	140	38.46	7.80	6.6
	6.0—7.9	50	6.6	8.0	129	46.90	7.45	6.5
	8.0—9.9	25	8.5	8.0	155	51.94	6.08	5.4
	10.0 and over	19	12.1	7.0	176	60.29	5.03	5.1
	Average	200	5.7	10.6	$139	$42.23	$ 7.40	6.5
Vetch silage	Less than 6.0	12	4.9	5.5	$121	$26.95	$ 5.50	3.3
	6.0—9.9	16	8.1	4.2	146	33.93	4.20	2.8
	10.0 and over	11	12.1	3.0	169	42.48	3.50	2.7
	Average	39	7.9	4.3	$144	$33.77	$ 4.27	3.0
Kale	Less than 15.0	16	11.3	3.0	$159	$58.80	$ 5.21	6.5
	15.0—19.9	22	16.7	3.5	141	64.14	3.83	5.1
	20.0—24.9	22	21.0	3.3	156	72.63	3.46	4.9
	25.0 and over	6	27.3	2.0	148	88.42	3.24	3.8
	Average	66	18.1	3.2	$151	$68.48	$ 3.78	4.9

TABLE XXII. RELATION OF VALUE OF LAND TO YIELD AND COST, 1925-1927

	Value of land per acre	Number of records	Average value of land per acre	Yield per acre	Cost per ton
				tons	
Corn silage	Less than $100	17	$ 76	4.8	$ 7.67
	100—150	89	109	5.4	7.55
	150—200	52	153	6.1	6.86
	200 and over	42	219	6.4	8.18
	Average	200	$139	5.7	$7.40
Vetch silage	Less than $100	-----	-----	-----	-----
	100—150	14	$104	6.7	$4.22
	150—200	18	154	7.5	4.53
	200 and over	7	205	10.9	3.95
	Average	39	$144	7.9	$4.27
Kale	Less than $100	4	$ 76	18.3	$3.64
	100—150	24	104	17.7	3.60
	150—200	18	150	17.1	3.83
	200 and over	20	208	17.6	4.07
	Average	66	$151	18.1	$3.78

TABLE XXIII. RELATION OF AMOUNT OF SEED CORN USED PER ACRE TO YIELD AND COST OF CORN SILAGE, 1925-1927

Pounds seed corn per acre	Number of records	Average amount of seed corn per acre	Yield per acre	Cost per ton	Value of land per acre
		lbs.	*tons*		
8.0 or less	80	7.4	5.4	$7.48	$133
Over 8.0	120	10.7	6.0	7.37	142
Average	200	9.4	5.7	$7.40	$139

TABLE XXIV. RELATION OF AMOUNT OF VETCH SEED USED PER ACRE TO YIELD AND COST OF VETCH SILAGE, 1925-1927

Amount of vetch seed per acre	Number of records	Average amount of seed per acre		Yield per acre	Cost per ton	Value of land per acre
		Vetch	Oats			
lbs.		*lbs.*	*lbs.*	*tons*		
Less than 40	16	27	72	6.6	$4.74	$143
40—49	13	43	49	8.2	4.02	145
50 and over	10	57	62	8.8	4.05	142
Average	39	39	61	7.9	$4.27	$144

TABLE XXV. RELATION OF CULTIVATION OF CORN TO YIELD AND COST, 1925-1927

Number of cultivations	Number of records	Yield per acre	Cost per ton	Value of land per acre
		tons		
1—2	28	4.5	$8.03	$121
3—4	94	5.3	7.66	138
5 or more	78	6.8	7.04	146
Average	200	5.7	$7.40	$139

TABLE XXVI. RELATION OF SIZE OF CREW TO COST OF FILLING SILOS AND OTHER FACTORS
(Corn Silage, 1925-1927)

Items	Number of wagons used 1-2	3-4	5-6	Average
Number of records	36	116	48	200
Average crew:				
Men	5	9	11	9
Horses	3	7	10	7
Tons of silage per farm	50	59	64	62
Tons per crew hour	1.8	4.0	5.7	3.6
Average length haul (rods)*	68	72	94	76
Cost filling silo, per ton:				
Man and horse labor	1.21	1.08	1.00	1.06
Machinery	.56	.45	.34	.45
Overhead labor	.29	.23	.21	.22
Total	$2.06	$1.76	$1.55	$1.71

*Data upon length of haul were obtained only for 1926 and 1927.

TABLE XXVII. RELATION OF AMOUNT OF CORN SILAGE PER FARM TO COST OF FILLING SILO AND OF USE OF SILO, 1925-1927

Tons of silage per farm	Number of records	Average number of tons	Cost per ton for filling silo	Cost per ton for use of silo
		tons		
Less than 50	95	32	2.21	$0.49
50—99	73	67	1.62	.46
100 and over	32	132	1.36	.25
Average	200	62	1.71	.41

TABLE XXVIII. HOURS OF LABOR PER ACRE ONCE OVER ON ALL FARMS PERFORMING OPERATION, ON 10 PERCENT OF FARMS WITH LOWEST MAN LABOR REQUIREMENT, AND ON 10% OF FARMS WITH HIGHEST MAN LABOR REQUIREMENT, 1925-1927

Operations	Number of records of operation	All farms		Lowest 10 %		Highest 10 %	
		Man-hours	Horse-hours	Man-hours	Horse-hours	Man-hours	Horse-hours
Manuring for corn, spreader	94	9.9	17.4	3.3	6.9	22.2	26.4
Manuring for kale, spreader	44	13.8	24.7	5.6	13.0	31.7	44.9
All manuring with spreader	143	11.2	19.8	4.1	8.8	24.1	31.3
All manuring, wagon or sled	31	15.4	26.6	9.8	19.6	31.4	47.8
Plowing for corn, horses	95	4.9	13.9	3.2	10.8	7.5	17.6
Plowing for corn, tractor	103	1.9	.....	1.1	.....	3.7	.....
All plowing, horses	202	4.8	13.5	2.7	9.5	7.6	17.4
All plowing, tractor	229	1.8	.....	1.1	.....	2.9	.....
Disking, horses	142	1.4	4.7	.7	2.5	2.6	7.0
Disking, tractor	232	.7	.....	.4	.....	1.2	.....
Rolling, horses	150	.8	2.3	.5	1.7	1.2	2.9
Rolling, tractor	26	.5	.....	.3	.....	1.0	.....
Spike harrowing, horses	341	.6	1.7	.3	1.1	1.0	2.4
Spike harrowing, tractor	31	.5	.....	.2	.....	.8	.....
Spring-toothing, horses	69	1.1	3.4	.5	2.5	1.7	3.8
Spring-toothing, tractor	54	.7	.....	.3	.....	1.2	.....
Floating, horses	49	.7	2.1	.4	.9	1.1	3.0
Floating, tractor	8	.6	.....	.4	.....	.8	.....
Drilling, horses	237	.9	2.6	.5	1.8	1.3	3.2
Drilling, tractor	15	.5	.....	.2	.....	1.0	.....
Planting corn with planter	189	1.1	2.2	.6	1.3	1.8	3.3
Marking and planting by hand	11	4.0	1.6	1.6	.9	8.2	4.3
Transplanting kale by hand	42	25.0	.....	12.8	.....	50.0	.....
Transplanting kale by machine	12	13.4	8.7	5.3	5.3	20.0	10.0
Cultivating corn, 2 horses	169	1.5	3.1	1.1	2.1	2.2	4.4
Cultivating corn, 1 horse	36	2.0	2.0	.9	.9	3.8	3.8
Cultivating kale	53	2.8	4.2	1.3	2.4	7.4	11.2
Cutting corn with corn-binder	100	1.7	4.4	1.0	2.8	3.1	6.9
Cutting corn by hand	94	6.1	.....	3.0	.....	11.2	.....
Filling silo, corn silage	200	13.0	10.4	5.9	5.6	26.5	19.6
Filling silo, vetch silage	39	18.4	13.9	7.4	9.4	39.5	26.7
Hauling kale	55	35.6	57.4	14.1	20.7	70.5	107.0

The figures for each operation are based upon the total number of records of the operation upon all of the Willamette Valley forage crops that were studied, including the hay crops as well as silage and kale.